

ELECTRONIC COUNTERS

Pulse/CW Microwave Counter

HP 5361B

- Built-in frequency profiling
- Frequency extensions to 26.5 GHz, 40 GHz
- Measure frequency (pulsed or CW), PRI, PRF, pulse width, offtime, and frequency profiles directly
- 1 Hz resolution on pulsed and CW signals
- Up to +50 dBm pulse level protection (optional)
- 60 ns minimum pulse width
- Measurements down to 1 Hz PRF



HP 5361B

HP 5361B Pulse/CW Microwave Counter

Make All Your Frequency Measurements with One Microwave Counter

The HP 5361B was designed for both high precision pulse and CW performance. It is the only pulse/CW microwave counter with frequency modulation profiling built in. Characterize radar, EW, and communications systems or components. Lower your equipment costs by eliminating the need for a separate CW counter, pulse generator, and computer.

Precision Pulse Measurement Provides Accuracy to Spare

The HP 5361B measures 40 GHz pulsed microwave signals with up to 1 Hz resolution. Six separate pulse microwave measurements are available to characterize your signals: frequency, PRF, PRI, pulse width, off-time, and frequency profiling.

True CW Performance at No Extra Cost

Count CW signals from 10 Hz to 40 GHz with 1 Hz resolution. Resolution improves to 0.001 Hz at 100 kHz. Other CW counter features include Fast Track and Low FM Rate. Fast Track enables the counter to measure a signal that is sweeping at up to 800 MHz/s. Low FM Rate allows measurements on a signal that is varying slowly in frequency.

Frequency Profiling Made Easy and Inexpensive

Intentional or unintentional FM on your carrier, such as a chirp, is easy to measure and plot with the HP 5361B and a printer. The function PROFILE, with a printer, makes it possible to accurately determine the frequency vs. time characteristics of your pulsed or CW signal, replacing a computer, pulse generator, and much software.

Frequency profiling is becoming more important as demands are increased on radar, EW, transponder, and communication equipment. Unwanted frequency perturbations on a switching voltage controlled/digitally tuned oscillator (VCO/DTO) degrade performance. If the linearity of a chirp deviates too much from the desired characteristics, the range side lobes will be out of spec. Characterizing frequency transients, modulation, and linearity is essential to lowering costs and increasing performance in future systems.

Previously, frequency profiling required a microwave counter, a pulse generator, a computer, software, and much interconnection. The PROFILE function allows you to make frequency measurements inside a pulse with no extra equipment, other than a printer. The printer is used to output a plot of frequency versus time.

Easy to Use Because It Is Automatic

An external gate is not needed for pulsed signals. Pushing the PROFILE key starts the profiling function. The signal is acquired, the pulse width measured, and frequency profiling started. When the profile is finished, it is sent to the printer for a permanent hard copy.

The Most Accurate Method of Frequency Profiling

Gating error is an inherent part of most counter architectures. It can be a small but consistent error of less than 100 ps. The algorithms and hardware associated with PROFILE reduce this gating error to a negligible amount, providing more accurate measurements.

Automatic Measurements Simplify Testing

The HP 5361B's suite of automatic features is designed to make your testing easier. The counter performs many automatic operations that must be done manually with other counters. All you need to do is connect your signal and choose the function, and the counter does the rest. Automatic features include:

Auto-Calibration: Performs a major calibration internally at power-up, or on command. No external connections are needed.

Auto-Assess: Determines whether the signal is pulsed or CW and shifts to the correct measurement routines.

Auto-Acquire: Acquires a signal from 500 MHz to 40 GHz.

Auto-Gate: Sets the gate width for CW signals (dependent on the selected resolution). Pulsed signals are assigned a gate width calculated to minimize measurement errors.

Auto-PRF: Allows you to measure the carrier frequency of signals with stable or changing PRIs, from 2 MHz to 50 Hz. A low-PRF mode allows measurements to 1 Hz PRF.

Auto-Position: Positions the gate inside the microwave pulse. Turn-on and turn-off transients do not corrupt the measurement.

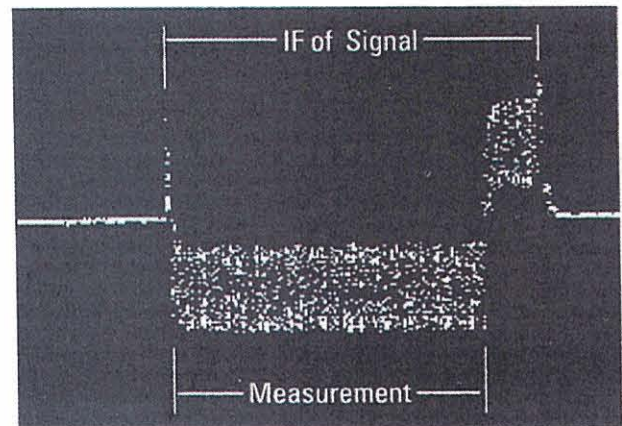
Auto-Track: Tracks a signal sweeping up to 800 MHz per second in Fast Track (after a CW signal has been acquired).

Auto-Resolution: Calculates the number of pulses to average for the true requested resolution. Smoothing improves resolution.

Auto-Indicate: Displays the measurement and indicates whether the signal is pulsed or CW.

Scope-View Gives You Confidence in Externally Gated Measurements

View the exact position of the measurement on any 100 MHz oscilloscope. For externally gated measurements, there is always a possibility that the gating signal may not coincide with the microwave pulse. Scope-View enables you to easily set up an externally gated measurement because you can see the downconverted pulse with a dc offset at the actual measurement interval.



Set up externally gated measurements with confidence using Scope-View.

A Cost-Effective Choice for Manufacturing and Service

Test software to control the HP 5361B can be written in 2 different ways. The counter can be controlled by English-like commands, or by Hewlett-Packard's Interactive Test Generator (ITG).

ITG: The Easiest Way to Generate Test Software—Use a Mouse

ITG can be used to generate test software for the HP 5361B. This allows the use of a mouse for easy code generation for a rack of instruments. The mouse is used to invoke different functions on graphical panels displayed on a computer. For more information, see page 79.

High-Speed Throughput Lowers Production Costs

The counter can also produce results at up to 100 measurements per second. The improved efficiency saves time and money.

Extended Calibration Cycles Keep the HP 5361B Working and Out of the Calibration Lab

The only periodic maintenance required for the HP 5361B is timebase calibration. Complete internal calibration is performed at power-up or upon command. To keep the counter out of the calibration lab even longer, Option 001 or 010 can be included. Option 010 extends the calibration cycle to 5 years, and still provides kHz measurement accuracy on a 40 GHz frequency measurement.

Power for Tomorrow's Radars, VCOs, and DTOs

The HP 5361B makes frequency, timing, and profiling measurements at the touch of a button. The counter also makes more complex measurements for the carrier frequency of agile signals, staggered PRIs, or the frequency transients in a pulsed or CW signal.

Frequency Modulation on the Pulse (FMOP) is Easy and Inexpensive to Quantify

Frequency-profiling a radar chirp to determine linearity or characterizing the droop when turning on a high-power stage is easy with the HP 5361B's PROFILE function and uses much less equipment.

One Counter Measures Radar Pulse Parameters and the STALO

The HP 5361B features state-of-the-art pulse microwave measurements without sacrificing its CW performance. This counter can characterize your radar pulse, and has the needed features for measurements that require high-CW precision, such as testing the Stable Local Oscillator (STALO). The counter measures with 1 Hz resolution up to 40 GHz.

Resist Input Burnout with a High Damage Level

Option 006 extends the damage level to +50 dBm for pulses of 1 μ s and less, or approximately +40 dBm for CW signals. The standard damage level, and damage level above 26.5 GHz, is +25 dBm, more than enough for lower-power applications.

The Right Mix of Features Simplifies VCO and DTO Testing

The HP 5361B has features to accurately and easily test VCOs and DTOs. PROFILE lets you measure the step response with gate widths down to 11 ns. Post-tuning drift and settling time can also be measured in this way. Fast Track is useful for measuring tuning linearity because it tracks a signal that is moving at up to 800 MHz per second. The counter outputs results at up to 100 readings per second.

Summary Specifications Functions

Frequency (pulse or CW), frequency profiling, PRF, PRI, pulse width, and offtime

Input characteristics

	Input 1 (50 Ω)	Input 2 (1 M Ω)	Input 2 (50 Ω)
Frequency Range	500 MHz to 20, 26.5, 40 GHz	10 Hz to 80 MHz	10 MHz to 525 MHz
Sensitivity		25 mV rms	25 mV rms
0.5 to 12.4 GHz	-28 dBm		
12.4 to 20 GHz	-23 dBm		
0.5 to 26.5 GHz (Opt 026, 040)	-20 dBm		
26.5 to 40 GHz (Opt 040)	$0.37 \times f(\text{in GHz})$ to 29.8 dBm		

Frequency (Input 1)

Automatic and manual acquisition:

500 MHz to 20 GHz; 500 MHz to 26.5 GHz (Opt 026); 500 MHz to 40 GHz (Opt 040)

Least significant digit: 1 MHz to 1 Hz for frequency, 0.001 Hz for PRF

Pulse frequency measurements

Pulse width (minimum): Manual mode, 60 ns; auto mode, 100 ns

Pulse rep freq: Minimum 1 Hz; maximum 2 MHz

Measurement time, resolution, accuracy: See datasheet

CW frequency measurements

FM tolerance: 55 MHz peak-to-peak

Tracking speed (fast acquisition): 800 MHz/s

Acquisition time: Manual mode, <40 ms; automatic mode, fast acq., <100 ms

Gate times (1 Hz resolution): 200 to 1000 ms

Measurement time: ≥ 8.5 ms (in Dump Mode)

Accuracy: See datasheet

Pulse parameters (Input 1)

	Pulse Width	PRI	Offtime	PRF
Min/Max	60 ns/10 ms	500 ns/1 s	400 ns/1 s	1 Hz/2 MHz
LSD	(PW < 1 ms) 1 ns; (PW \geq 1 ms) 100 ns			to 0.001 Hz
Accuracy (100 Avg.)	$\pm (20 \text{ ns} + \text{timebase uncertainty} \times \text{measurement} \pm \text{LSD})$		$\pm (20 \text{ ns}) \times (\text{PRF})^2 \pm \text{LSD} \pm \text{timebase uncertainty}$	

Profile (Input 1)

Frequency range (min/max for Y axis): 500 MHz/40 GHz

FM chirp tolerance (max span for Y axis): 50 MHz peak-to-peak

Time range (min/max span for X axis): 100 ns/10 ms

Time resolution: 1 ns

Internal gate width: Minimum: 11 to 23 ns

Typical minimum: 14 ns

External gate width: Minimum: Manual acquisition 20 ns

Auto-acquisition 60 ns

Number of data points: Up to 100

Profile frequency measurements

Printers supported: HP 2225A, HP 2227B, HP 3630A Opt 002

Profile phase measurements: See Application Note 377-4 for details. Computer required.

Frequency (Input 2)

Range: 10 Hz to 525 MHz

Accuracy: 0.001 to 1 Hz

Resolution/LSD: 0.001 to 1 Hz

Options

Option 001 oven timebase: Aging rate < 5×10^{-10} /day

Options 006, increased damage level: Pulsed, +50 dBm (100 W) peak; CW, +39 dBm (8 W)

Option 010 high-stability oven timebase: Aging rate < 7×10^{-10} /week

(Standard timebase: Aging rate < 1×10^{-7} /month)

Option 026: Frequency extensions for input 1 to 26.5 GHz

Option 040: Frequency extensions for input 1 to 40 GHz

Ordering Information

HP 5361B Pulsed/CW Microwave Counter	Price
Opt 001 Oven Timebase	+ \$950
Opt 006 Microwave Limiter	+ \$950
Opt 010 High-Stability Timebase	+ \$1,500
Opt 026 26.5 GHz Frequency Extension	+ \$2,600
Opt 040 40 GHz Frequency Extension	+ \$7,000
Opt 700 MATE Interface	+ \$750
Opt 908 Rack Mount Kit for Use with Front Handles Removed	+ \$34
Opt 910 Additional Operating and Programming Manual	+ \$80
Opt 913 Rack Mount Kit for Use with Supplied Front Handles	+ \$83
Opt 915 Service Manual	+ \$215
Opt W30 Extended Repair Service (see page 671)	+ \$315
Opt W32 Calibration Service (see page 671)	+ \$525